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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/820,692
Filing Date: March 30, 2001
Appellant(s): CHIEN ET AL.

Asaf Batelman
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed July 14, 2005.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments

The appellant's statement of the status of amendments contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be reviewed on Appeal

The appellant's statement of the *Grounds of Rejection to be Reviewed on Appeal* in the brief is substantially correct. The changes are as follows:

Claims 1-4, 7-12, and 14-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6,451,703) in view of Schmitt (US 6,228,438) as evidenced by Demmin (US 6,635,185) Tahara (US 5,356,515) and Loewenstein (US 5,741,396).

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

6,451,703	LIU et al.	9-2002
6,228,438	SCHMITT	5-2001
6,635,185	DEMMIN et al.	10-2003
5,356,515	TAHARA et al.	10-1994
5,741,396	LOEWENSTEIN	4-1998

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1-4, 7-12, and 14-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US 6,451,703) in view of Schmitt (US 6,228,438) as evidenced by Demmin (US 6,635,185) Tahara (US 5,356,515) and Loewenstein (US 5,741,396). **(Please note that Demmin (US 6,635,185) Tahara (US 5,356,515) and Loewenstein (US 5,741,396) were cited as evidence in the body of the rejections, see non-final rejection 08/30/2004, page 4 and final rejection 12/14/2004, page 4).**

In a method of oxide etching, Liu teaches a method of etching a dielectric layer with selectivity to an underlying stop layer. A semiconductor substrate is supported in a plasma etch reactor wherein the etch reactor is capacitively coupled plasma reactor including a showerhead electrode (col.4, lines 40-42). MERIE (a capacitively coupled plasma reactor) may be used (col. 4, lines 5-7). The substrate includes a dielectric layer (e.g., oxide layer) over a nitride stop layer. An etchant gas may be supplied to the plasma etch chamber with the showerhead (col. 4, line 42). Etching openings may be

performed in the dielectric layer by energizing the etchant gas into a plasma state. The etchant gas may comprise a hydrogen-free fluorocarbon gas represented by C_xF_y gas wherein $y/x < 1.5$. Liu also teaches that the chamber pressure may be varied (Fig. 7; col. 11, lines 36-37) from 25mT to 70 mT, which overlaps the claimed range. See col.1, lines 38 through col. 2, line 15; col. 4, lines 5-65 and col. 5 lines 4-8. Tables 1 and 4, Figures 2 and 7.

Liu teaches using capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode. The claimed invention differs from Liu by specifying a dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode. Schmitt is relied on only to show the well-known feature such as dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode as claimed (see col. 1, line 15-17; col. 8, lines 1-12). Hence, it would have been obvious to one with ordinary skill in the art to incorporate those features as disclosed by Schmitt in the process of Liu in order to separately control the upper electrode and lower (bottom) electrode.

As to dependent claim 18, in order to complete the etching of the openings, keeping an amount of etchants sufficient to avoid etch stop is expected in the method of Liu.

Dependent claims 3, 19 and 21 differ from Liu by specifying various etching selectivities. However, the skilled artisan recognizes that in plasma etching, changing the flow rates of etchants and the power change the plasma densities and fluxes, and ion energy, and change the etching properties and etching selectivity. Hence, it would

have been obvious to one with ordinary skilled in the art to vary the flow rates of etchants and process parameters in order to produce desired etch rate selectivity.

The above cited claims differ from Liu by specifying various compositions (e.g., flow rates of etchants (such as claims 8 and 14) processing parameters (such as pressure range at 50-100 m Torr, temperature at 20 to 50 C, and RF energy). However, they are recognized result-effective variables, and commonly determined by routine experiment. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, it is the examiner's position that a person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify Liu by performing routine experiments (by using various compositions and different processing parameters) to obtain optimal result in order to produce the best etched product achievable. See Demmin (US 6,635,185) ,Tahara (US 5,356,515) and Loewenstein (US 5,741,396) in the record as evidences. Demmin (US 6,635,185; Col. 7, lines 5-25) discloses that one skilled in the art of plasma etching may vary composition, flow rate, temperature, pressure, power, time, and bias voltage accordingly to etch a desired material satisfactorily. Tahara (US 5,356,515) discloses that etch rate and selectivity as a function of flow rate (Fig. 8, 10). Loewenstein (US 5,741,396) discloses that selectivity as function of (composition) ratio of etchants, also teaches to vary pressure, temperature, gas flow, power, frequency, see col.8, lines 3-12 and Figures.

Changes in compositions, temperature, concentrations, or other process conditions of a process do not impart patentability unless the recited ranges are critical (i.e., they produce a new and unexpected result that differs in kind and not merely in degree from the result of the prior art). *In re Woodruff*, 16USPQ2d 1934,1936 (Fed. Cir.1990); *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809; *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). MPEP 2144.05 II.

(10) Response to Argument

Appellant has argued (page 7 and page 9 of appeal brief) that Liu does not disclose using a showerhead electrode. It is incorrect. As stated in the office action, Liu teaches using a showerhead electrode (col.4, lines 40-42).

Appellant has argued that only Liu teaches etching dielectric oxide, Schmitt does not teach etching dielectric oxides. It is not persuasive. As has been stated in the office action, Schmitt is relied on only to show the well-known features such as dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode. The system of Schmitt is capable of etching various materials, see col. 1, lines 1-40. Since Liu teaches etching dielectric oxide, the combined prior art teaches etching dielectric oxide.

One cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *In re* Merk &Co., Inc., 800F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Appellant has argued that Liu uses MERIE, and there is no motivation to incorporate dual frequency showerhead electrode of Schmitt. It is not persuasive. In

fact, MERIE (magnetically enhanced reactive ion etching process) can also use a capacitively coupled plasma reactor as stated in the office action. Magnetical enhancement feature is simply an added feature to the etching apparatus whenever there is a need for the process. Furthermore, Liu also use showerhead electrode (col. 4, lines 40-42). Schmitt is relied on only to show the well-known features such as dual frequency capacitively coupled plasma reactor including an upper showerhead electrode and a bottom electrode, it would have been obvious to one with ordinary skill in the art to incorporate the dual frequency as disclosed by Schmitt in the process of Liu in order to separately control the upper electrode and lower (bottom) electrode, as has been stated in the office action. The examiner clearly show the motivation of using dual frequency showerhead electrode is to separately control the upper electrode and lower (bottom) electrode.

Appellant has argued that the claimed invention uses different ranges of pressure and temperature. It is not persuasive. As stated in the office action, they are recognized result-effective variables, and commonly determined by routine experiment. The process of conducting routine experimentations so as to produce an expected result is obvious to one of ordinary skill in the art. In the absence of showing criticality or new, unexpected results, a person having ordinary skill in the art at the time of the claimed invention would have found it obvious to modify Liu by performing routine experiments (by using various compositions and different processing parameters) to obtain optimal result in order to produce the best etched product achievable. See Demmin (US 6,635,185) ,Tahara (US 5,356,515) and Loewenstein (US 5,741,396) as evidence.

Furthermore, appellant argued that Liu teaches an upper limit of 40 mT that teaches away from the claimed invention. It is not persuasive. In an example of obtaining high oxide etch rate (such as near 700 nm-min), Liu states that the pressure should no more than 40 mT, it is simply an example under a given particular product requirement (col. 11, lines 36-49). In fact, Liu teaches that the chamber pressure may be varied (Fig. 7) from 25mT to 70 mT, which overlaps the claimed range.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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August 19, 2005

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